

**GCSE (9–1) Biology A (Gateway Science)**  
**J247/04 Paper 4 (Higher Tier)**  
Sample Question Paper

**H**

**Date – Morning/Afternoon**

Version 2.1

Time allowed: 1 hour 45 minutes



**You may use:**

- a scientific or graphical calculator
- a ruler



<b>First name</b>					
<b>Last name</b>					
<b>Centre number</b>					
<b>Candidate number</b>					

**INSTRUCTIONS**

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION**

- The total mark for this paper is **90**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document consists of **28** pages.

**SECTION A**

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

- 1** Different diseases are caused by different pathogens.

Which row in the table shows the type of pathogen that causes each disease?

	<b>HIV/AIDS</b>	<b>Tobacco Mosaic Disease</b>
<b>A</b>	virus	virus
<b>B</b>	bacterium	virus
<b>C</b>	bacterium	fungus
<b>D</b>	virus	fungus

Your answer

[1]

- 2** Which of these examples of human defence mechanisms against disease is non-specific?

- A** antibodies in the blood system
- B** memory cells
- C** hydrochloric acid in the stomach
- D** lymphocytes

Your answer

[1]

3 New medicines are tested before they can be used.

There are people that object to some forms of testing.

Which form of testing is likely to cause the **least** objection?

- A animal testing
- B computer simulation testing
- C human tissue testing
- D microbial testing

Your answer

[1]

4 There are different levels of organisation within an ecosystem.

What is the correct order of these levels?

- A individual, community, population, ecosystem
- B community, individual, ecosystem, population
- C individual, population, community, ecosystem
- D population, community, ecosystem, individual

Your answer

[1]

- 5 Eva investigates the number of daisy plants growing on the school playing field. She uses a quadrat to count the number of daisy plants growing in different areas of the field.

The table shows her results.

quadrat	number of daisy plants
1	8
2	2
3	7
4	5

Each quadrat has an area of  $0.25\text{m}^2$ .

The school playing field has an area of  $15000\text{m}^2$ .

Estimate the population of daisy plants growing on the school field.

- A 682  
 B 82500  
 C 330000  
 D 1320000

Your answer

[1]

- 6 Look at the information about a food chain.

Organism	Number	Biomass
Oak tree	1	500,000
Aphids	10,000	1,000
Ladybirds	200	50

Calculate the percentage biomass of the aphids transferred to the ladybirds.

- A 0.05%  
 B 20%  
 C 5%  
 D 2000%

Your answer

[1]

- 7 Palm oil is used in the manufacture of biscuits, crisps, cereals and many other processed foods.

Palm oil production has a negative effect on the environment.

Which statement identifies a **negative** effect of palm oil production?

- A Palm oil plantations are found in countries with tropical rainforest.
- B Palm oil production has increased due to the demand for more processed food.
- C Palm oil plantations support a low biodiversity.
- D Palm oil production provides jobs for the local community.

Your answer

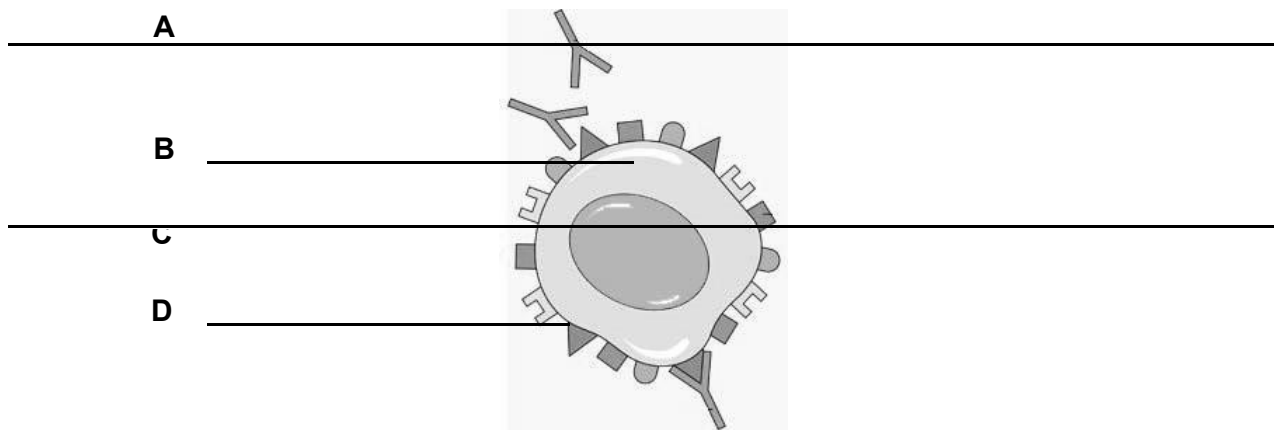
[1]

- 8 Monoclonal antibodies can be used to treat some kinds of cancer.

Look at the diagram of a cancer cell.

It is being treated using monoclonal antibodies.

Which label, **A, B, C or D**, shows the monoclonal antibodies?



Your answer

[1]

9 Stem cells are used in treating some medical conditions because they:

- A are unspecialised
- B bind to and immobilise pathogens
- C destroy cancer cells
- D differentiate into many different types of cell.

Your answer

[1]

10 A mouse has a diploid chromosome number of 40.

Which row in the table shows the correct number of chromosomes in each cell?

	Number of chromosomes in	
	a mouse egg cell	a mouse eye cell
<b>A</b>	40	40
<b>B</b>	20	20
<b>C</b>	20	40
<b>D</b>	40	20

Your answer

[1]

11 Scientists have tested the genes of a number of people who have diabetes.

They have found that there are about four different versions of a gene that can cause diabetes.

Why might this discovery be important?

- A Diabetes cannot be treated at the current time.
- B Different patients with diabetes can be given different drugs.
- C All types of diabetes can be treated by changing the diet.
- D Glucagon injections will be able to treat these four types of diabetes.

Your answer

[1]

**12** FOP is a disorder that causes soft tissue in the body to turn to bone.

It is caused by a dominant allele.

People who have this condition are often infertile.

Natural selection predicts that the number of children born with the condition will go down.

Which explanation can explain why the number of people with FOP is staying constant?

- A** The allele is being produced regularly by mutation.
- B** Dominant alleles can remain hidden for generations.
- C** The allele may increase the rate of meiosis.
- D** The allele has no effect on a person's phenotype.

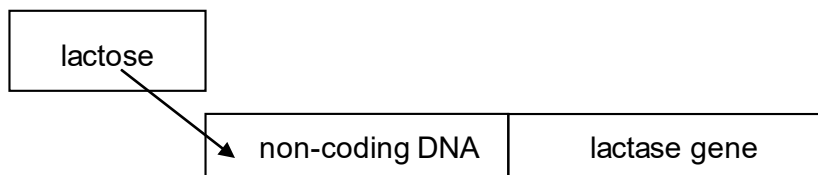
Your answer

**[1]**

**13** Bacteria can produce an enzyme called lactase which digests lactose.

The enzyme is only made when lactose is present.

This is because there is a non-coding area of DNA which switches the lactase gene on.



Bacteria can have a mutation in the non-coding DNA.

What is a possible effect of such a mutation?

- A** Lactase cannot be made even if lactose is present.
- B** Lactase is made but will have a different order of amino acids.
- C** Lactase is made but it will be the wrong shape to digest lactose.
- D** Lactose is made rather than lactase.

Your answer

**[1]**

**14** Bacteria are used in genetic engineering.

A plasmid is used to transfer the required DNA into the bacterium.

What is the term used to describe role of the plasmid in this technology?

- A** enzyme
- B** host
- C** transgenic
- D** vector

Your answer

**[1]**

**15** Some plants have been genetically engineered so that they grow larger.

Each cell of the plant has a new gene inserted so that it produces a different protein.

What does genetic engineering do to the plant?

- A** It changes the phenotype and the genotype.
- B** It changes the genotype but not the phenotype.
- C** It changes the phenotype but not the genotype.
- D** It changes neither the genotype nor the phenotype.

Your answer

**[1]**



**SECTION B**

Answer **all** the questions.

**16** Some students are investigating lichens.

Lichens are often studied because they are sensitive to pollution.

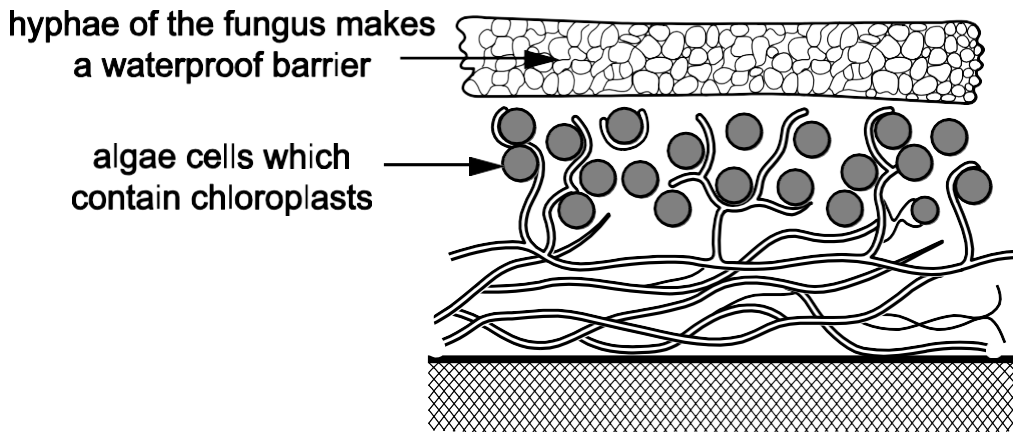
**(a)** Lichens are made up of two different organisms: a fungi and algae.

Both the fungus and the algae gain from living together.

What biological name is given to a relationship where both organisms gain?

..... **[1]**

**(b)** The students find a diagram of a lichen.



Using the information from the diagram suggest what the algae and fungi each gain from their relationship.

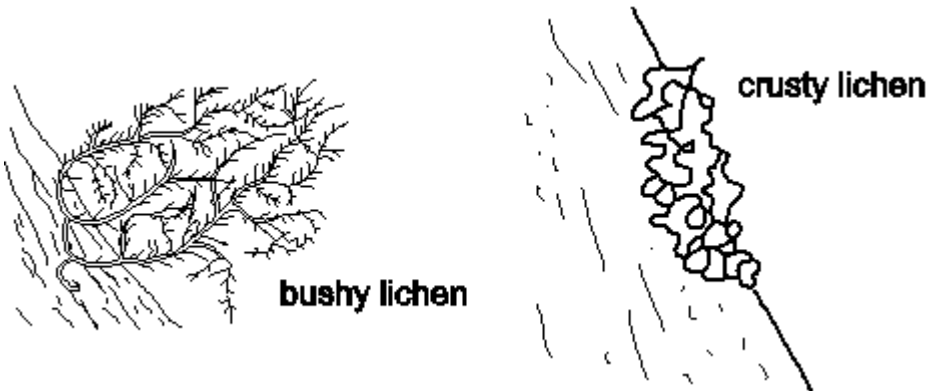
algae.....

.....

fungus.....

..... **[2]**

- (c) Lichens are sensitive to pollution because they take up chemicals from the air.  
The diagram shows a 'bushy' species of lichen and a 'crusty' species of lichen.



Bushy lichens are usually more sensitive to pollution than crusty lichens.

Use the diagrams to suggest why.

.....  
..... [1]

- (d) The students decide to use lichens to try and work out how polluted their school grounds are.

They read about a scale called the Lichen Diversity Value (LDV).

It is worked out in this way:

- choose four trees in the area
- hold a quadrat on the north side of the trunk of one tree
- count the total number of all the lichens in the quadrat
- then do this on the east, south and west side of the tree
- repeat this for each tree.

- (i) Suggest how the students could choose four trees.

.....  
..... [1]

(ii) The students put their results into a table.

Number of individual lichens found in each quadrat				
Tree number	North	East	South	West
1	3	11	18	7
2	4	12	17	8
3	5	10	15	12
4	4	15	12	9
mean	4.0	12.0	15.5	

The LDV is found by adding together the four mean values.

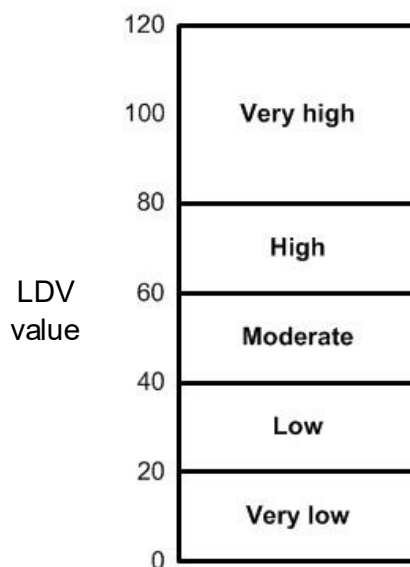
The students calculate the mean number of lichens on the north, east and south sides of the trees.

Calculate the mean for the west side and use this to calculate the LDV.

LDV = .....

[2]

(iii) This scale shows the diversity of the lichens shown by the LDV.



What does the LDV show about the diversity of lichens in the school grounds?

.....

..... [2]

(iv) LDV is calculated by counting all the lichens present.

What else about the lichens could the students look for to make a better assessment of pollution?

.....

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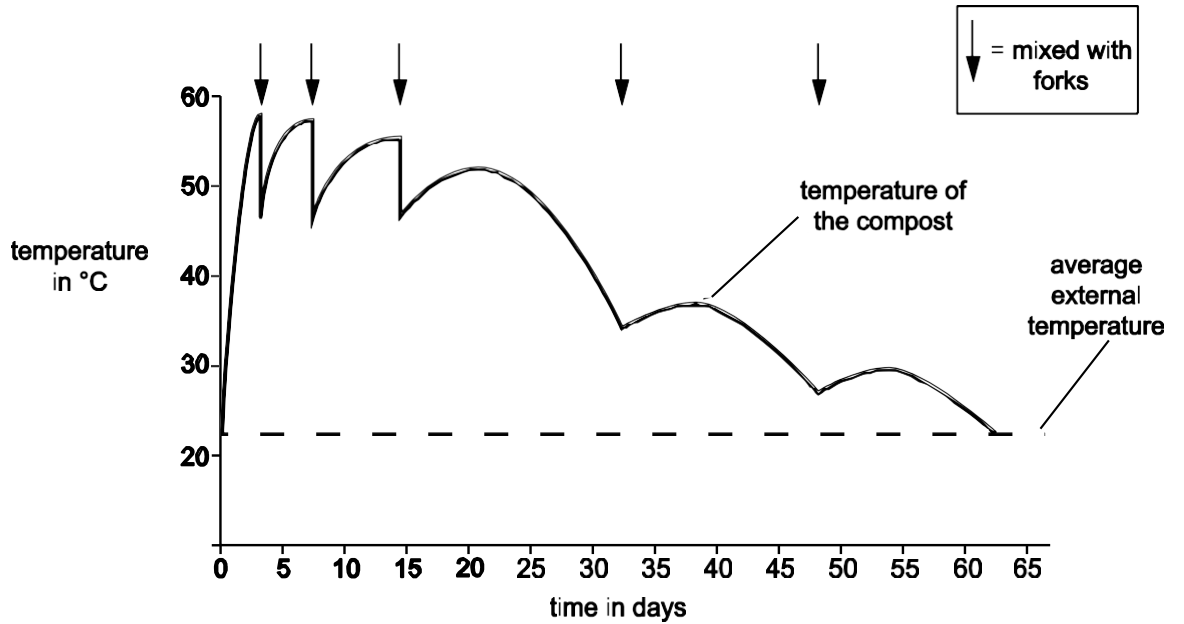
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..... **[3]**

17 Some students measured the temperature inside a compost heap. They also measured the external temperature. On five occasions they mixed up the compost heap with garden forks. The graph shows their results.



(a) (i) The compost took 63 days to completely decompose.

Explain how the students could tell this from their graph.

.....

.....

..... [1]

(ii) The rate of temperature increase is greatest before the compost is mixed for the first time.

Explain how the rate of temperature change can be calculated.

.....

.....

..... [1]

**(b)** Compost decomposes more slowly above 60°C or below 30°C.

Use ideas about enzymes and decomposition to explain why this is.

.....  
.....  
..... **[2]**

**(c)** Use the graph to describe how the forking helps to provide the best temperature for decomposition.

.....  
.....  
..... **[2]**

18 Erythromycin is an antibiotic drug.

(a) What is an antibiotic?

.....  
.....  
..... [2]

(b) It is important to get the dose of erythromycin right.

Too much erythromycin can be harmful.

However, recently some strains of bacteria have developed resistance to low concentrations of erythromycin.

To see how effective erythromycin is, it is tested using bacteria grown on agar plates.

This method is used:

- A petri dish is used that has the bacteria growing evenly over the surface.
- A disc of filter paper is soaked in erythromycin.
- The disc is placed on the agar in the centre of the petri dish using sterile forceps.
- The dish is incubated at 37°C.

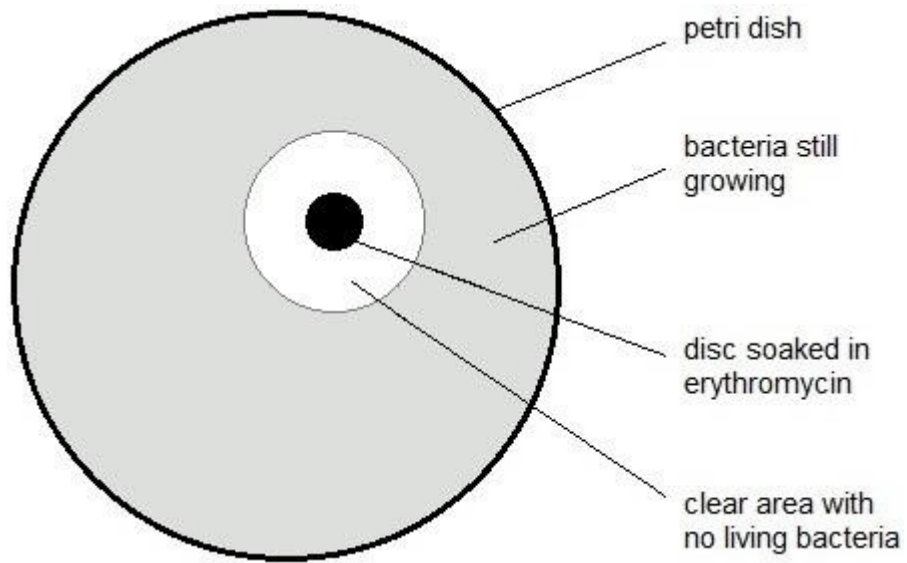
(i) Why did the scientists incubate the dish at 37°C rather than at higher or lower temperature?

.....  
..... [2]

(ii) Why is the filter paper disc moved using sterile forceps?

..... [1]

(c) (i) The diagram shows the actual size of the dish after incubation.



This table is used to analyse the results of the experiment.

Area clear of bacteria including the area of the disc in mm <sup>2</sup>	Level of resistance
less than 133	resistant
133 to 416	intermediate resistance
more than 416	not resistant

Use the results of the experiment and the table to judge the level of resistance in this strain of bacteria. (The area of a circle =  $\pi r^2$  and  $\pi = 3.14$ .)

answer= ..... mm<sup>2</sup> [3]

(c) (ii) Suggest any limitations to measuring the level of resistance with this method.

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..... [2]

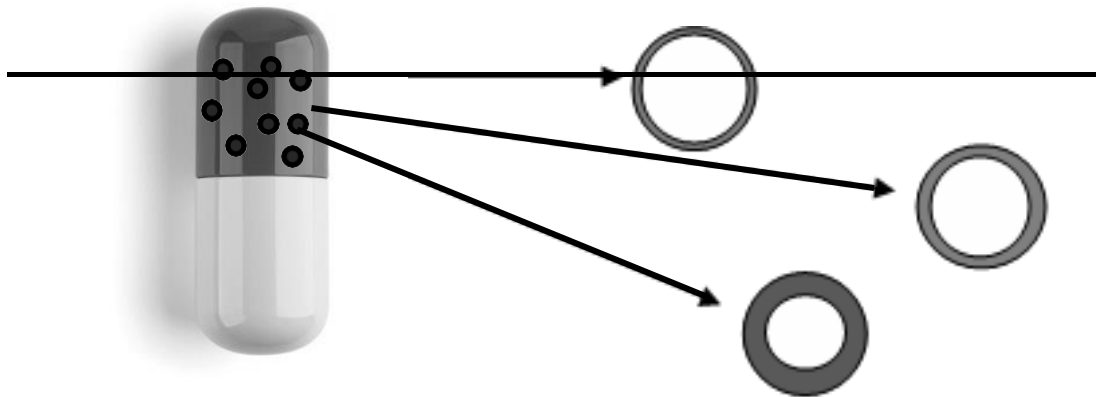


(d) Erythromycin is usually given to patients in a capsule.

The capsule has lots of small spheres containing the drug.

The walls of the spheres are different thicknesses.

They are made of a carbohydrate polymer.

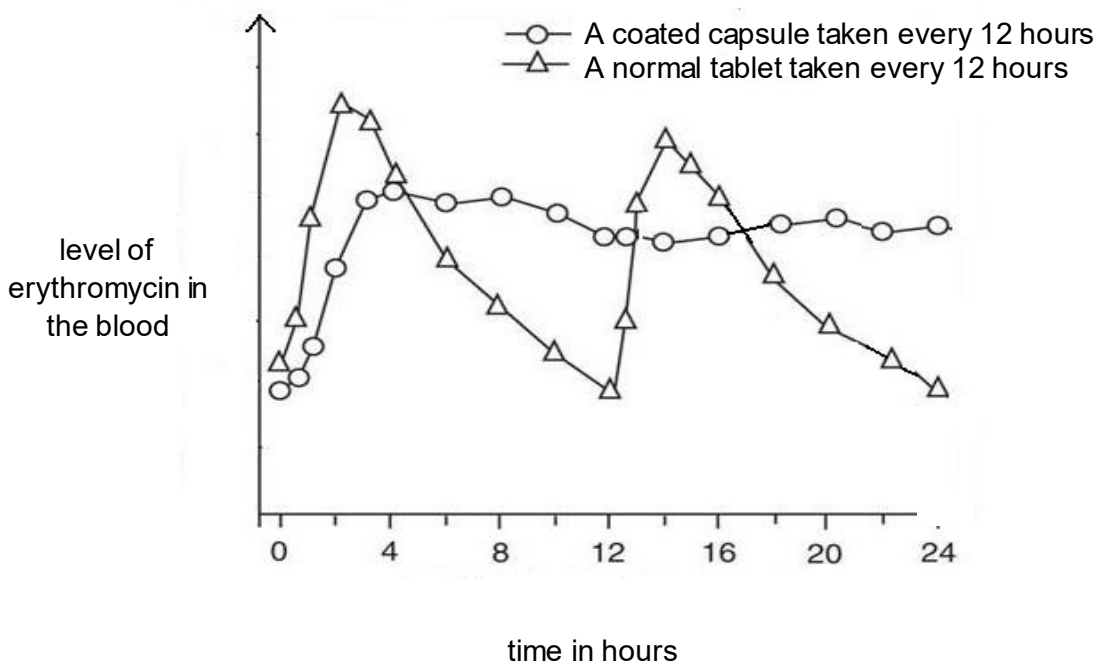


(i) Explain why the drug is released from the spheres in the small intestine.

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..... [2]

(ii)\* The graph shows the levels of erythromycin in the blood when given using this capsule and in a normal tablet.



Explain the shape of the two graphs and why it is better to give erythromycin in capsules.

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[6]

19 Wolfram’s Syndrome is a genetic disorder.

It is caused by a recessive allele (n).

In people with Wolfram’s syndrome, a protein does not function correctly.

(a) Explain how a change in an allele can stop a protein functioning correctly.

.....

.....

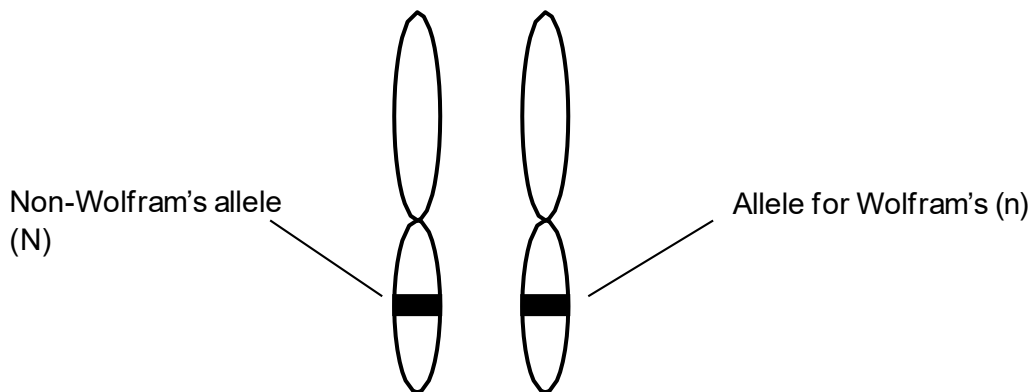
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**[4]**

(b) The diagram shows a pair of chromosomes from a person called Tim.



Fill in the table to show Tim’s genotype and phenotype.

Choose your answers from this list.

- does not have Wolfram’s syndrome
- has Wolfram’s syndrome
- heterozygous
- homozygous dominant
- homozygous recessive

genotype	
phenotype	

**[2]**

(c) (i) Meena is expecting a baby.

Tim is the father.

Complete this genetic diagram.

		Tim	
Meena	N		
	n		

[2]

(ii) Wolfram’s syndrome can affect the pancreas.

Meena and Tim’s doctor tells them that there is a chance that their baby will have problems controlling their blood glucose level.

Explain why the doctor thinks this.

Use information from part (c) (i) and your biological knowledge.

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[4]

**20** In many countries people rely on bananas for food.

Black sigatoka is a disease of banana plants.

It is caused by a fungus.

**(a)** Explain how the food security/growth of bananas could be improved:

**(i)** by using fungicide.

.....  
..... **[1]**

**(ii)** by using selective breeding.

.....  
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.....  
.....  
..... **[3]**

- (b) Scientists have been investigating the conditions needed for the fungus to grow.

They compiled this data.

Conditions needed for fungus to grow		
	Temperature in °C	Percentage humidity (%)
Grows well	25 - 28	>90
Some growth	20 – 25 or 28 - 35	90 - 80
Will not grow	< 20 or >35	<70

Write in the boxes how well the fungus will grow in these conditions.

25 °C and a humidity of 85%	
27 °C and a humidity of 92%	

[2]

- (c) Scientists have tried to predict the effect of climate change on the growth of the fungus.

They have used four different predictions for how the climate might change, **A, B, C** and **D**.

They then tried different ways of calculating where the fungus cannot grow.

Their results are shown in the table.

Climate model	Percentage area of the world where fungus cannot grow (%)			
	1 <sup>st</sup> calculation	2 <sup>nd</sup> calculation	3 <sup>rd</sup> calculation	4 <sup>th</sup> calculation
<b>A</b>	87.6	87.9	87.7	87.8
<b>B</b>	88.4	88.6	89.0	88.8
<b>C</b>	91.1	91.5	91.4	91.3
<b>D</b>	88.4	88.9	89.5	89.2

- (i) Which climate model produces the lowest **range** of results in the four calculations? Choose from **A, B, C** or **D**.

..... [1]

- (ii) At present the fungus **cannot** grow over 86.4% of the World.

What do the calculations predict about the effect of climate change on the fungus?

..... [1]

(d) Scientists are developing a genetically engineered banana plant.

This would be resistant to black sigatoka.

Look at the newspaper headline from an African newspaper.

**Trouble at the genetic research station**

Police have been called to a research station.

They are needed to guard the genetically modified plants.

This is because people have been trying to steal the plants to grow themselves.

In Europe, police have been used to guard genetically engineered crops from protesters.

Suggest why the protesters in Europe want to destroy the crops and why the response in Africa is so different.

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..... [2]

21 Strokes are a type of cardiovascular disease.

One cause of a stroke is an artery in the brain bursting.



(a) (i) When a person has a stroke, why are arteries more at risk of bursting than veins?

..... [1]

(ii) How are arteries adapted to try and prevent them bursting and causing a stroke?

..... [1]

(b) Strokes can have many risk factors.

Scientists are trying to investigate whether the risk of having a stroke is increased by pollution.

They looked at data from 28 different countries, involving six million people.

They looked at the number of people who had a stroke soon after an increase in pollution.

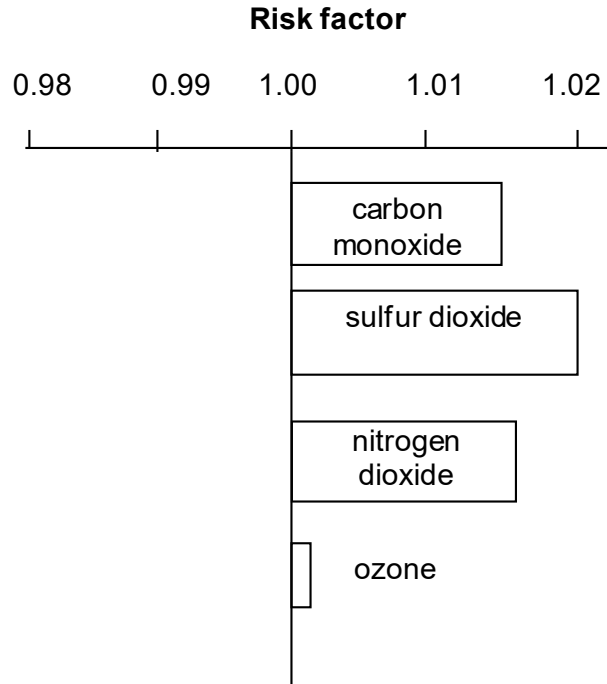
They compared this to the number of people who had a stroke after no increase in pollution.

This formula was used to produce a risk factor:

$$\text{risk factor} = \frac{\text{number of people who had a stroke soon after an increase in pollution}}{\text{number of people who had a stroke after no increase in pollution}}$$

The graph shows their results.





(i) If the risk factor for a pollutant was 1.00, what conclusion could the scientists make?

.....  
 ..... [2]

(ii) Which pollutant is least likely to be a risk factor for a stroke?

..... [1]

(iii) The risk factors calculated by the scientists are quite small.  
 However, they still think that pollution is an important factor in strokes.  
 How did the nature of the data they used help to convince them of this?

.....  
 ..... [2]

**22** The rock pocket mouse is a small grey coloured mouse that lives in Mexico.



These mice are the main food for owls.

Rattlesnakes also feed on these mice.

The mice get most of their food from grass plants and grass seeds.

**(a) (i)** How many trophic levels are there in the feeding relationships described?

..... **[1]**

**(ii)** Draw a labelled pyramid of biomass for these feeding relationships.

**[2]**

(b) Scientists have been studying an area of Mexico that is covered with black rocks.

Most of the rocks in other areas are grey.

The black rocks were formed about 1000 years ago when a volcano erupted.

They found that most of the mice that lived on this rock were black in colour.

(i) Explain how the population of mice in this area became mostly black.

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..... [5]

(ii) Changes to populations of mice, bacteria and insects can happen over fairly short time periods.

Explain why changes to species such as humans take much longer.

.....

.....

..... [2]

**END OF QUESTION PAPER**

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**...day June 20XX – Morning/Afternoon**

**GCSE (9–1) Biology A (Gateway Science)**

**J247/04 Paper 4 Higher Tier**

**SAMPLE MARK SCHEME**

**Duration:** 1 hour 45 minutes

**MAXIMUM MARK    90**

**This document consists of 16 pages**

**MARKING INSTRUCTIONS****PREPARATION FOR MARKING****SCORIS**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

**MARKING**

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
  - a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
  - b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
  - if there is nothing written at all in the answer space
  - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
  - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.** If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

**In summary:**

**The skills and science content determines the level.**

**The communication statement determines the mark within a level.**



## 11. Annotations

<b>Annotation</b>	<b>Meaning</b>
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument

## 12. Subject-specific Marking Instructions

### INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Biology A:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
<b>AO1.1</b>	Demonstrate knowledge and understanding of scientific ideas.
<b>AO1.2</b>	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
<b>AO2.1</b>	Apply knowledge and understanding of scientific ideas.
<b>AO2.2</b>	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
<b>AO3.1a</b>	Analyse information and ideas to interpret.
<b>AO3.1b</b>	Analyse information and ideas to evaluate.
<b>AO3.2</b>	Analyse information and ideas to make judgements and draw conclusions.
<b>AO3.2a</b>	Analyse information and ideas to make judgements.
<b>AO3.2b</b>	Analyse information and ideas to draw conclusions.
<b>AO3.3</b>	Analyse information and ideas to develop and improve experimental procedures.
<b>AO3.3a</b>	Analyse information and ideas to develop experimental procedures.
<b>AO3.3b</b>	Analyse information and ideas to improve experimental procedures.

## SECTION A

Question	Answer	Marks	AO element	Guidance
1	D	1	1.1	
2	B	1	1.1	
3	B	1	1.2	
4	C	1	1.1	
5	C	1	2.2	
6	B	1	2.2	
7	B	1	2.1	
8	A	1	1.2	
9	D	1	1.1	
10	B	1	2.1	
11	C	1	2.2	
12	C	1	2.1	
13	A	1	2.1	
14	D	1	1.2	
15	B	1	2.1	

## SECTION B

Question		Answer	Marks	AO element	Guidance	
16	(a)	mutualism (1)	1	1.1		
	(b)	algae gain protection (1)	1	2.1	<b>allow</b> idea about prevention of drying out / absorbing water / minerals	
		fungi gain sugars (1)	1	2.1		
	(c)	larger surface area (to take up pollutants) (1)	1	2.1	<b>allow</b> sticks out more from bark	
	(d)	(i)	use of random numbers (1)	1	1.2	
		(ii)	40.5 (2)	2	2.2	<b>allow</b> correct mean i.e. 9.0
		(iii)	moderate diversity (1)	1	3.1a	<b>allow</b> ECF from (d) (ii)
			only just above low / closer to low than high (1)	1	3.2a	
		(iv)	identify the species of lichens present in their sample (1)	1	3.3b	<b>allow</b> reference to bushy / crusty
			find out how sensitive to pollution these lichens are (1)	1	3.3b	
			if the lichens are mostly pollution sensitive species = low pollution levels (1)	1	3.3b	

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	the temperature of the heap was the same as the external temperature (1)	1	2.2	
		(ii)	Change in temperature $\div$ time  <b>OR</b>  Tangent drawn from line and used to calculate rate	1	2.2	
	(b)		above 60°C the enzymes in the decomposers had denatured (1)  below 30°C the enzymes in the decomposers were working too slowly (1)	1  1	1.2  1.2	
	(c)		initially / for the first three times forking reduces the temperature / stops it getting too hot (1)  towards the end forking helps to increase the temperature (1)	1  1	3.1a  3.1a	

Question		Answer	Marks	AO element	Guidance	
18	(a)	<b>two from:</b>				
		a chemical (usually) made by fungi / microbes (1)	1	1.1		
		that kills (other) microbes / kills bacteria (1)	1	1.1		
	(b)	(i)	any higher and the bacteria might be killed / bacterial enzymes denatured (1)	1	2.2	<b>allow</b> optimum temperature for the bacteria / bacterial enzymes
			any lower and the erythromycin would diffuse slower / bacteria would reproduce more slowly so takes longer to get the results (1)	1	2.2	<b>allow</b> spread out slower
		(ii)	prevent contamination by other microbes (1)	1	1.2	<b>not</b> germs / bugs
	(c)	(i)	correct area = 452(mm <sup>2</sup> ) (2)	2	2 x 2.2	<b>allow</b> 452.2
			not resistant (1)	1	3.2b	<b>allow</b> one mark for correct calculation and interpretation using incorrect radius
		(ii)	only one plate used / no replicates (1)	1	3.3b	
			only gives limited information, i.e. one of three choices (1)	1	3.3b	
	(d)	(i)	coat is digested / broken down(1)	1	2.1	
			by enzymes present in small intestine (1)	1	1.1	

Question	Answer	Marks	AO element	Guidance
(ii)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b> <b>Explains the shapes of the two graphs in the effectiveness/safety of the drugs delivery system</b> <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> <b>Explains the shapes of the two graphs the total dosage of the drugs</b> <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> <b>Simply describes the patterns in the graph</b> <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>	6	2 x 2.1 2 x 2.2 2 x 3.2a	<p><b>AO3.2a: Analyse the information and judge the relative effectiveness of the two delivery systems</b></p> <ul style="list-style-type: none"> <li>• links this to the advantages / disadvantages of keeping a steady, intermediate level in the blood.</li> <li>• with tablet high levels may be toxic</li> <li>• if reduce the dose, then when levels low it may not kill all bacteria</li> <li>• reference to allowing resistant strains to develop</li> </ul> <p><b>AO2.2: Apply knowledge to demonstrate an understanding of how the capsules and tablets work in delivering the drug</b></p> <ul style="list-style-type: none"> <li>• Any statement regarding the total dosage for the two delivery methods</li> <li>• Dosage rises rapidly because of rapid absorption into the blood stream</li> <li>• Dosage falls fast because it is rapidly broken down</li> <li>• capsules allow staggered release of drug dosage</li> <li>• this is because walls are different thicknesses of the capsule</li> <li>• therefore different digestion time</li> <li>• conventional tablet releases drug all at once</li> <li>• tablet may not have a coating</li> </ul> <p><b>AO2.1: Apply knowledge and understanding in reading the graphical information</b></p>



Question			Answer	Marks	AO element	Guidance	
						<ul style="list-style-type: none"> <li>Simple description of the patterns of the two lines on the graph.</li> </ul>	
Question			Answer	Marks	AO element	Guidance	
19	(a)		change in base sequence of DNA (1)	1	1.1		
			change in order of amino acids (1)	1	1.1		
			protein shape changes (1)	1	1.1		
			reference to shape not being suited to function e.g. change in enzymes active site shape (1)	1	1.1		
	(b)		heterozygous (1)	1	2.1		
			does not have Wolfram's syndrome (1)	1	2.1		
	(c)	(i)	Alex's and Nina's genotypes Nn (1)	1	2.2	<b>allow</b> correctly completed punnet square	
				correct genotypes of offspring (NN, Nn, Nn, nn) (1)	1		2.2
		(ii)	baby may be nn (1)	1	2.1		
				one in four chance of baby being affected (1)	1	3.1b	
				pancreas produces insulin (1)	1	2.1	
				insulin controls blood glucose level (1)	1	1.1	

Question			Answer	Marks	AO element	Guidance
20	(a)	(i)	kills the fungus (that is killing the bananas) so protects/increases the crop/yield (1)	1	1.1	
		(ii)	choose the most resistant individual / banana (1)	1	1.2	
			allow it to reproduce (1)	1	1.2	
			repeat this process over many generations (1)	1	1.2	
	(b)		some growth (1)	1	3.2a	
			grows well (1)	1	3.2a	
	(c)	(i)	A (1)	1	2.2	
		(ii)	Show that it will be able to grow in less area (all calculations greater than 86.4) (1)	1	3.2b	
	(d)		protesters in Europe think that genetic engineering is ethically wrong / not safe (1)	1	3.2a	
			people in Africa need the food as less is available (1)	1	3.2a	

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	blood in arteries is under higher pressure (1)	1	1.1	
		(ii)	arteries have thicker walls / elastic walls (1)	1	1.1	
	(b)	(i)	number of people having strokes is the same after pollution compared to when there is no pollution (1)	1	2.2	
			pollution is not a risk factor in strokes (1)	1	3.1a	

Question			Answer	Marks	AO element	Guidance
		(ii)	ozone (1)	1	3.2b	
		(iii)	data from 28 countries / 6 million people / large sample (1)	1	1.2	
			even a small risk factor number means a lot of people (were affected) (1)	1	1.2	

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	three (1)	1	1.1	
		(ii)	correct tapering pyramid shape (1)	1	1.2	
			grass/grass seeds at bottom, mice next and owls and rattlesnakes at the top (1)	1	1.2	
	(b)	(i)	black colour produced by mutation (1)	1	1.1	Maximum three marks without reference to rattlesnake / owl predation or camouflage
			black mice better camouflaged (1)	1	1.1	
			black mice less likely to be eaten from rattlesnakes/owls (1)	1	2.1	
			survive to reproduce (1)	1	1.1	
			past on the gene for black colour (1)	1	1.1	
		(ii)	humans reproduce more slowly (1)	1	2.1	ORA
			go through less generations in a certain time (1)	1	2.1	ORA

## Summary of updates

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Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website
October 2019	2.1	Question 16(a)- Mark Scheme correction from 40.4 to 40.5